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A STREPTOTHRIX ISOLATED FROM THE BLOOD OF A PATIENT BITTEN BY A WEASEL (STREPTOTHRIX PUTORII)

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The streptothrix described in this article was isolated from the blood of a patient bitten by a weasel. The clinical history, which is typical of rat-bite fever, follows:

A boy, 10 years of age, entered St. Luke's Hospital, Oct. 8, 1917, in the service of Dr. Joseph Brennemann, to whom we are indebted for the privilege of this report. He had been bitten August 10, by a weasel, on the right thumb and left hand. Shortly afterward the wounds were cauterized, and soon they healed. Two weeks later a swelling appeared on the left hand, which became quite large and rather blue in color. The right thumb also became swollen. The axillary glands were enlarged. The patient had fever and general malaise.

On entrance, edema of the lower eyelids was observed. The epitrochlear, axillary and cervical glands were slightly enlarged, and the axillary glands were tender. White blood cell count was 19,000, with 88% polymorphonuclears, 8% large lymphocytes, 4% small lymphocytes. The urine was normal. Wassermann reaction positive. Wassermann reaction of mother and one brother also positive. The temperature was irregular, sometimes rising every day, sometimes at 6 day intervals, the highest point being 106 F. No appetite; vomiting sometimes at the onset of attacks of fever. With each paroxysm, which generally lasted 1 day, edema of the lower eyelids appeared; also an eruption, chiefly on the face and to a slight extent on the chest, of bluish red, sharply defined macules, varying in size from 2-3 cm.

At the onset of the third attack in the hospital, the previous one having been extremely severe, the patient received a small dose of neosalvarsan. This and the following attacks were very mild. The patient was discharged Jan. 1, 1918, in good condition, although the temperature still rose, at times to 101 F.

A point of interest is that another boy, helping to rescue the patient from the weasel, was also bitten, but did not develop the disease. Similar observations have been made in cases of rat-bite fever, two persons being bitten by the same rat, but only one developing rat-bite fever.

Routine blood cultures made during the first paroxysm in the hospital gave on the anaerobic plate a gram-negative bacillus, which did not grow and a gram-positive diplo-streptococcus, which produced hardly any hemolysis, fermented dextrose, lactose and maltose, but not saccharose, inulin and mannite. This coccus was agglutinated by the patient's serum at 1:80, but not by normal serum, and it also gave

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indications of fixing complement. The coccus was not pathogenic for rabbits or guinea-pigs. Cocci were not found in other blood cultures.

Blood for cultures was drawn again, about 6 hours after the onset of the second attack in the hospital, at the height of the paroxysm, the temperature being 106 F. Cultures were made on plain agar plates, also shake cultures, and in ascitic broth, ascitic fluid and on Loeffler's blood serum slants. In 48-72 hours three to four colonies appeared on the 4 agar plates; the other cultures remained sterile. The colonies were grayish-white, pinpoint in size and regular in outline.

Some of the blood collected in citrate solution was examined with dark field illumination. No spirochetes were observed, but three immobile filaments, from 8 to 20 microns in length and possibly some beaded forms were seen. Blood smears stained with the Giemsa stain and with iron hematoxylin did not show any organisms, but one stained with warm carbol-gentian-violet showed two filaments 8 and 10 microns long, slightly irregular and beaded. They were found only after a long search. According to Tileston[1] the filaments described by him in the blood of his case of rat-bite fever were most abundant early in the paroxysm and become scarcer in each succeeding attack. This may account for the few organisms observed in this specimen of blood.

We were unable to find spirochetes in the blood, urine, eye or cutaneous lesions of the patient. Whole blood, drawn during a paroxysm, was injected into guinea-pigs, but failed to produce any fever. No spirochetes were found in their blood.

The isolated organism is nonmotile, slender, curved, and branching, varying a good deal in length, with bacillary and coccal forms. Branching is most marked in young cultures. Ball and club-shaped terminal swellings are observed, and pleomorphism is marked. When first isolated mostly short forms were seen, later filaments were common, but none of great length or wavyness. The organism is gram-negative, stains with ordinary stains, and is not acid fast.

A facultative anaerobe, it grows better under aerobic conditions. Growth generally occurs in 24-48 hours on blood agar and Loeffler's blood serum as discrete, colorless or grayish-white, pinpoint circular, elevated colonies with sharp margins. At first they appear dull, later become glistening. The medium is not changed. Growth in dextrose blood agar is more profuse and grayish-yellow in color. The growth in ascitic broth is slight, but whitish and flocculent. Growth occurs also in inulin, salicin, maltose, mannite, saccharose, raffinose, lactose and dextrose broths to which ascitic fluid is added (1:4), but there is no change in reaction. There is slight growth only in plain and dextrose broth and milk; on plain and dextrose agar a yellowish-white, glistening growth develops.

The organism is killed by exposure to 57 C. for half an hour.

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[1] Jour. Am. Med. Assn., 1916, 66, p. 995.

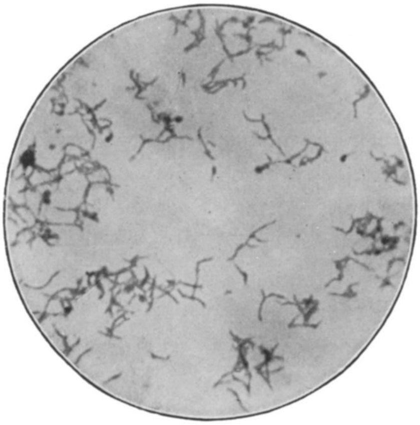
When first isolated it died out quickly and grew with difficulty. After growth was established it remained viable at 37 C. for several weeks and grew more profusely.

Two guinea-pigs were inoculated intraperitoneally with the growth on 3 blood-agar slants. One died on the 6th day after injection, but no lesions were found. The cultures from the blood and kidney were sterile. The other guinea-pig was ill on the 6th day, but recovered. There was no rise in temperature in either animal.

Two young white rats were inoculated intraperitoneally with the growth on 3 blood agar slants. One died on the 3rd day, the other on the 5th day after injection. No lesions were found, and the cultures from the blood and kidneys were sterile. A wild rat was injected with the growth on one slant without any effect.

The blood of each of these animals was examined daily with dark field illumination; but no organisms were observed.

After the streptothrix had been isolated several weeks, the growth on 2 blood-agar slants was inoculated intraperitoneally into 2 white mice, without result.



Twenty-four-hour growth on blood agar. Carbol-gentian-violet. × 1,000.

Between two attacks the patient's blood showed a slight increase in opsonins for the streptothrix. The point of opsonic extinction for normal blood was 1:15; for the patient's blood 1:30; during an attack the point of extinction was 1:60. There was no agglutination with normal serum, but agglutination at 1:20 with the patient's serum. The serum of the patient in the presence of the organism fixed complement, and as stated the Wassermann reaction was positive. Fixation tests with Streptothrix muris-ratti isolated from a rat was negative. Soon after neosalvarsan was given the serum no longer fixed complement.

The serum of 7 rats with bronchopneumonia gave complement fixation with this streptothrix in three instances, with 4 strains of Streptothrix muris-ratti in three instances, and with both the organisms in one instance. All the strains of Streptothrix muris-ratti were isolated from the lungs of rats with bronchopneumonia.

Nixon[2] observed that the symptoms of rat-bite fever may be produced by the bite of another animal besides the rat. His patient, a ratter, was bitten by a ferret. He cites another case in his neighborhood, of a man bitten by a ferret, showing the same symptoms. The disease described by Schottmüller[3] as following the bite of a South African squirrel was a pyemia, with purulent skin lesions.

Futaki,[4] Kaneko,[5] Ido,[6] and Kitagawa,[7] have found spirochetes—Spirochaeta morsus-muris—in blood films, skin lesions, lymph glands, kidneys and suprarenals of patients with rat-bite fever in Japan. Similar spirochetes have been found by them in the blood of mice and other animals inoculated with human material. The spirochete has been grown in one generation, from the blood of an infected animal. In Germany and America, a streptothrix—Streptothrix-muris-ratti—has been isolated from the blood of 3 patients with rat-bite fever (Schottmüller, Blake,[8] and Litterer[9]) and observed in the fresh blood in a fourth case by Tileston.

Middleton,[10] in England isolated from a case of rat-bite fever a diplococcus from an anaerobic gelatin blood culture, but did not study its cultural characteristics. Recently Douglas, Colebrook and Fleming[11] studied a case of rat-bite fever and were unable to grow any streptothrices or spirochetes in aerobic or anaerobic blood cultures in simple broth or broth plus trypsin. This is not strange as neither organism as a rule grows in these mediums. They, however, isolated a streptococcus pyogenes from one enlarged gland. On account of the patient's serum agglutinating this organism at 1:60 and as the patient recovered after receiving a vaccine, they regard the condition as due to the streptococcus.

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[2] Brit. Med. Jour., 1914, 2, p. 629.

[3] Dermat. Wchnschr., 1914, 58, Supplement, p. 77.

[4] Jour. Exper. Med., 1916, 23, p. 249; 1917, 25, p. 33.

[5] Ibid., 1917, 26, p. 363.

[6] Ibid., 1917, 26, p. 377.

[7] Arch. Int. Med., 1917, 20, p. 317.

[8] Jour. Exper. Med., 1916, 23, p. 39.

[9] Jour. Tenn. State Med. Assoc., 1917, 10, p. 310.

[10] Lancet, 1910, 1, p. 1618.

[11] Ibid., 1918, 1, p. 253.

The streptothrix isolated from the blood of the boy bitten by a weasel differs from Streptothrix taraxeri cepapi obtained by Schottmüller[3] from the pus of the skin lesions and the blood of a patient, bitten by a South African squirrel, in being gram-negative. Schottmüller's streptothrix died before its cultural characteristics were determined. Culturally the weasel streptothrix differs from Streptothrix muris-ratti isolated by Schottmüller, Blake, and Litterer, from the blood of patients with rat-bite fever and also from a similar streptothrix isolated from bronchopneumonia of rats by Tunnicliff,[12] in growing not only more profusely but also in growing on plain and dextrose agar and in plain and dextrose broth and milk; it differs further in not forming long and wavy filaments. On account of these differences, we suggest naming this organism Streptothrix putorii.

CONCLUSIONS

A streptothrix—Streptothrix putorii—has been isolated from the blood of a patient bitten by a weasel.

The clinical picture was similar to that of a rat-bite fever, but the streptothrix differs both morphologically and culturally from the organism associated with that disease, Sterptothrix muris-ratti.

[12] Jour. Infect. Dis., 1916, 19, p. 767.